E-COMMERCE RECOMMENDATION SYSTEM

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ABSTRACT

The popularization of today's e-commerce sites made a big impact on IT technologies. Since e-commerce companies want the best experience for their customers, many technologies are involved to create that experience. One way to gain loyal customers is to build recommendations based on the other opinions. Since the best recommendations are based on the customers opinions and experience we can use that knowledge to build a recommendation system. In this research paper we have combined big data technologies with machine learning in order to create the best model for recommending products in e-commerce sites. We achieved such a result by utilizing two different approaches for normalization and performing cross validation on them. Recommending systems are changing from novelties used by a few E-commerce sites, to serious business tools that are re-shaping the world of E-commerce. Many of the largest commerce Web sites are already using recommending systems to help their customers find products to purchase. A recommending system learns from a customer and recommends products that she will find most valuable from among the available products.

Keywords: E-Commerce, Recommendation Systems, Interface, Content Based Filtering, Customer Loyalty, Cross-Sell

1. INTRODUCTION

In his book Mass Customization (Pine, 1993), Joe Pine argues that companies need to shift from the old world of mass production where —standardized products, homogeneous markets, and long product life and development cycles were the rule‖ to the new world where —variety and customization supplant standardized products.‖ Pine argues that building one product is simply not adequate anymore. Companies need to be able to, at a minimum, develop multiple products that meet the multiple needs of multiple customers. The movement toward Ecommerce has allowed companies to provide customers with more options. However, in expanding to this new level of customization, businesses increase the amount of information that customers must process before they are able to select which items meet their needs. One solution to this information overload problem is the use of recommender systems. Recommender systems are used by Ecommerce sites to suggest products to their customers. The products can be recommended based on the top overall sellers on a site, based on the demographics of the customer, or based on an analysis of the past buying behavior of the customer as a prediction for future buying behavior. Broadly, these techniques are part of personalization on a site, because they help the site adapt itself to each customer. Recommender systems automate personalization on the Web, enabling individual personalization for each customer. Personalization to this extent is one way to realize Pine's ideas on the Web. Thus, Pine would probably agree with Jeff Bezos, CEO of Amazon.com™ , when he said —If I have 2 million customers on the Web, I should have 2 million stores on the Web. ‖ Recommender systems enhance Ecommerce sales in three ways:

Browsers into buyers: Visitors to a Web site often look over the site without ever purchasing anything. Recommender systems can help customers find products they wish to purchase.

Cross-sell: Recommender systems improve cross-sell by suggesting additional products for the customer to purchase. If the recommendations are good, the average order size should increase. For instance, a site might recommend additional products in the checkout process, based on those products already in the shopping cart.

Loyalty: In a world where a site's competitors are only a click or two away, gaining customer loyalty is an essential business strategy (Reichheld and Sesser, 1990) (Reichheld, 1993). Recommender systems improve loyalty by creating a value-added relationship between the site and the customer. Sites invest in learning about their users, use recommender systems to operationalize that learning, and present custom interfaces that match customer needs. Customers repay these sites by returning to the ones that best match their needs. The more a customer uses the recommendation system – teaching it what they want – the more loyal they are to the site. —Even if a competitor were to build the exact same capabilities, a customer … would have to spend an inordinate amount of time and energy

teaching the competitor what the company already knows.‖ (Pine, et al. 1995) Finally, creating relationships between customers can also increase loyalty. Customers will return to the site that recommends people with whom they will like to interact.

2. RECOMMENDATION SYSTEM EXAMPLE

1. Amazon

With millions of products on Amazon, consumers may get distracted by what they want to buy; an increase in product variety will result in increased consumer decisionmaking time.Amazon recommendation systems filter in likely items to help consumers find a satisfactory product.

2. Spotify

Spotify evaluates which songs its users enjoy listening to and will recommend new music accordingly. They also curate a Discover Weekly playlist for users to discover new yet familiar music. Spotify's hybrid filtering algorithm helps listeners discover new music by learning their likes, dislikes, and nuances.

3. Netflix

Netflix is known for its extensive use of recommendation systems. With over 80% of content watched on Netflix coming from algorithmic suggestions, their recommendation system generates an estimated 1 billion dollars of revenue per year.Furthermore, new Netflix accounts will rate popular shows and movies to help the recommendation algorithm predict new shows to avoid the cold start problem.

4. Google and Youtube

With one of the most popular search engines and browsers available, Google spends fortunes updating its recommender system efficiency and accuracy as much as possible.In the search engine, Google will generate auto-fill results based on recent searches to help users find what they are looking for, increasing user satisfaction.Google also deploys recommendation systems on Youtube by implementing personal suggestion and rating systems using filters like views, likes, shared videos, subscriptions, genres, and more. Youtube also utilizes popularity suggestions to generate views on highly trending videos.
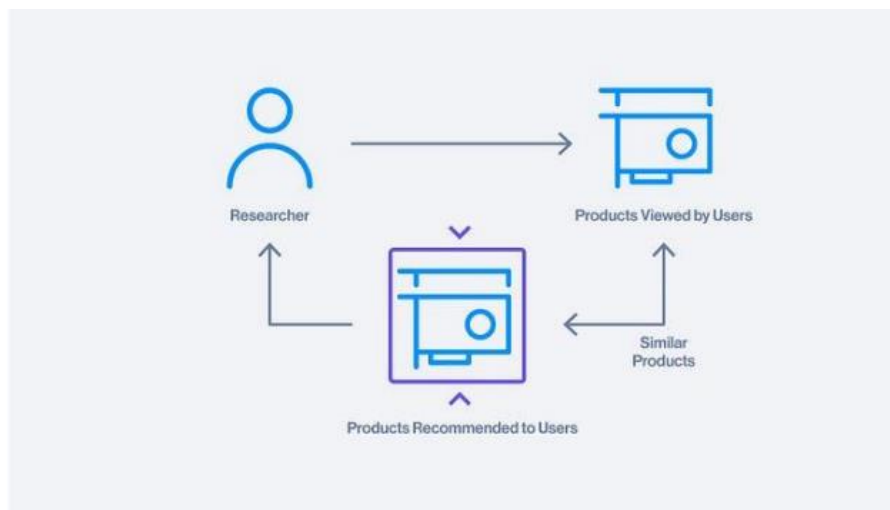
3. RECOMMENDATION SYSTEM

Fig. 1. Recommendation systems

Recommendation systems (RS) are the most important factor in ecommerce and several applications; the RS utilizes data mining techniques and tools to predict user's preference by utilizing their previous shopping information's and selecting products among the tremendous amount of available items for the users [2]. A recommendation system obtains the interest and preference of consumer and performs recommendations accordingly, so it is broadly used in every ecommerce websites. Recommender Systems have the potential to help and improve the quality of the decisions consumers make while searching for and selecting products online. With the tremendous growth of ecommerce, due to the huge nature of the information, the data overload problem has created. So, the users are not able to effectively get items on the ecommerce websites or web. In the electronic world, RS has introduced the need for information filtering techniques that are use to help users by filter out information in which they are interested in. Recommendation systems are one of the approaches applied for the ecommerce recommendation system which is based on providing possible items of interest to a user instead of the user to go searching for them. RS changed the way as the websites

communicate with their users. Instead of providing a static feel for the users, in product searching, this provides potential suggestions which increases communication to provide a higher experience. This also reduces the problem of stock unavailability. RS recognize recommendations autonomously for individual users based on their previous search, shopping histories, profiles, rating and other reviews given to item and this also considers the other users behavior too. List of recommendations in given below Types of Recommendation Systems Depending on the products or services that a business offers, different recommendation systems may be put into place. Some examples of different systems are:

1. Collaborative Filtering The collaborative filtering method focuses on the similarity between different users and items.

Consumers who share an overlap of similar interests will more than likely be interested in other similar products. These similarities can improve recommendations to all users within the data set and continue to learn as new products come into the market.For example, if Alex likes football and buys a pair of cleats and Meg likes football, thenMeg will more than likely also be interested in those cleats.

2. Content-Based Filtering Content-Based Filtering recommendation algorithm evaluates the similarity of products. The recommendation system will suggest products with similar classifications to the user previously interacted with. For example, if the last three watched movies included the comedy genre, the system will recommend other similar comedy movies or shows. Such recommendations are also imperative with product images using Image Processing or Natural Language Processing to match items that look, are titled, or described similarly. Note that similarity-based recommendations will suffer from the cold start problem. The cold start problem occurs when there is not enough preference data. The recommendation system can not accurately suggest great options when initially implemented on the platform since it takes time to gather and train.

3.Hybrid Filtering Hybrid filtering utilizes both collaborative and content-based filtering, utilizing the advantages of each other. Several studies comparing the performance of hybrid filtering systems with the collaborative and content systems alone have shown that hybrid systems have better accuracy.

4. RECOMMENDATION INTERFACES AND WAYS TO MAKE MONEY

An old proverb states that there is ―more than one way to skin a cat.‖ One would assume that the method selected depends on the desired outcome. Similarly, there is more than one way to display recommendations to a customer. The method selected may well depend on how the e-commerce site wants the customer to use the recommendation. In the following we will examine seven recommendation interfaces, and how each assists the site in making money. While some of these methods have their roots in traditional commerce, each of them draws upon the strengths of the electronic medium to provide more powerful recommendations. Browsing: In traditional commerce a customer might walk into a video store and ask the clerk to recommend ―a comedy from the 50s.‖ Ideally, the clerk would recommend several movies, and the customer could go off to locate the recommended movies, browse the box covers, and see which ones appealed to them. However, the quality of the recommendations provided was dependent on the particular clerk's knowledge of an enormous range of movies. Reel.com has several advantages when implementing browsing into their Movie Map feature. First, the recommendations of several clerks/editors can be combined so that higher quality recommendations can be provided no matter what the query parameters. Furthermore, recommendations are returned with immediate links to the items being recommended – no more searching the store for the obscure videos recommended. Recommended browsing helps the Ecommerce site by converting browsers into buyers. It does so by helping the users narrow down their choices and feel more confident in their decision to buy by providing organized access to the recommendations. Similar Item: Another modification of traditional commerce techniques is the similar item recommendation. Systems such as Reel.com's Movie Matcher, Amazon.com's Customer's who Bought and one variation of CDNOW's Album Advisor attempt to expose customers to items they may have forgotten about, or of which they may have simply been unaware. Their implementation in Ecommerce sites allows for more specific and personalized recommendations. The items displayed can be entirely selected based on the item(s) in which a customer has shown interest. In doing so, sites increase customer's exposure to their product line, and ideally are able to sell more items per order. Email: Recommendations can also be delivered directly to customers through email, in a extension of traditional direct mail techniques. Amazon.com's Eyes feature allows them to notify customers the minute an item becomes commercially available. Eyes enables Amazon.com to attract customers into their store before other stores with the same product can reach those customers.. Furthermore, both Eyes and Amazon.com Delivers allows the site to keep a customer aware of the site and of items the customer may have missed. Customers appreciate the email recommendations because they help them watch out for new items they are interested in purchasing. These features assist the site in making money by increasing both loyalty, and the number of return

visits Text Comments: More and more frequently, sites are providing customers with recommendations based directly on the text comments of other customers. Amazon.com's Customer Comments and eBay's Feedback Profile streamlines the gathering of ―the word on the street‖ by allowing customers to locate an item of interest and browse the comments of other customers. This helps sites make money by providing impartial information on the goods/services being sold – the thought being, if enough people claim that a book is good, or a seller is credible, than it is likely to be true. This not only helps convert browsers into buyers, but should increase loyalty to a site. If customers learn they can trust these third party recommendations, than they are more likely to return the next time they are faced with a questionable decision. Average Rating: Even simpler access to ―the word on the street‖ is the average rating feature. Rather than asking customers to browse a list of text based opinions, other customers can provide numerical ranking opinions. By aggregating these rankings into an average rating, Customer Comments and Feedback Profile both provide users with a ―one stop‖ check on the quality of an item. Similar to text comments, average ratings should facilitate in converting browsers into buyers, and increasing customer loyalty to the site.

5. RELATED WORK

Many kinds of research on RSs in ecommerce fields have been performed. The present section explains review articles, which discuss the utilization of RS in e-commerce applications and summarizes their main advantages and disadvantages. Xiao and Benbasat [33] studied e-commerce product recommendation agents and considered empirical papers on e-commerce product offering agents issued from 2007 to 2012. They selected 34 papers to review such highlighted topics as recommendation agent type, preference-elicitation, explanation, and the social aspects of recommendation agents. Also, they covered the operative features of social recommendation agents, variables for user perception such as pleasure, comprehended recommendation quality, comprehended trade-off issue, and comprehended social presence, and modifying factors, including gender, regulatory focus, reactance level, temporal distance, and decision context. They presented the refreshed conceptual model of the recommendation agent to conduct further research. However, the study mostly focused on some issues, such as social presence, perceived usefulness, trust, satisfaction, and perceived ease of use as the user's evaluation factors of recommendation agents. Using the conceptual model is a significant point in their research. Lu et al. [34] reviewed the papers published between 2013 and 2015 in the application developments of RSs in eight basic rankings, including egovernment, e-business, e-commerce/eshopping, e-library, e-learning, e-tourism, e-resource services, and e-group activities [35]. They examined RS's techniques systematically in some perspectives, such as recommendation methods, RS software, real-world application domains, and application platforms. Also, they used multiple databases for searching papers, such as Science Direct, ACM Digital Library, IEEE Xplore, and SpringerLink. Their review is significantly valuable in both describing the content and categorizing the methods. Furthermore, Karimova [36] reviewed the papers on ecommerce recommender system techniques published between 2014 and 2016 in journals and conference proceedings. He examined the developments of e-commerce recommender systems from the viewpoint of e-commerce providers or e-vendors. He searched the journal databases like ACM Digital Library, IEEE Xplore, Science Direct, and SpringerLink. The paper included such critical results as the dominant role of traditional RS techniques in e-commerce, especially collaborative filtering and hybrid methods, improving the personalized recommendation with high accuracy, and the researchers' efforts to overcome problems, for example, decreasing computational complexity and improving recommendation accuracy. The author employed the SLR strategy for the review process. Li and Karahanna [37] reviewed 40 empirical investigations of the recommendation system published from 1990 through 2013. Indeed, they classified the selected papers in three major fields, including understanding consumers, delivering recommendations, and the impacts of recommendation systems. Furthermore, some significant terms like customization, interactive decision aid system, personalization, recommendation system, and recommendation agent proposed in the review. The study included some tables with valuable summarized information in addition to reviewing the selected papers, and also it refers to a set of theories that RSs used.

6. ADVANTAGES & DISADVANTAGES

Advantages: Revenue — With years of research, experiments and execution primarily driven by Amazon, not only is there less of a learning curve for online customers today. Many different algorithms have also been explored, executed, and proven to drive high conversion rate vs. nonpersonalized product recommendations. Customer Satisfaction — Many a time customers tend to look at their product recommendation from their last browsing. Mainly because they think they will find better opportunities for good products. When they leave the site and come back later; it would help if their browsing data from the previous session was available. This could further help and guide their eCommerce activities, similar to experienced assistants at Brick and Mortar stores. This type of customer satisfaction leads to customer retention. Personalization — We often take recommendations from friends and family because we

trust their opinion. They know what we like better than anyone else. This is the sole reason they are good at recommending things and is what recommendation systems try to model. You can use the data accumulated indirectly to improve your website's overall services and ensure that they are suitable according to a user's preferences. In return, the user will be placed in a better mood to purchase your products or services. Discovery — For example, the ―Genius Recommendations‖ feature of iTunes, ―Frequently Bought Together‖ of Amazon.com makes surprising recommendations which are similar to what we already like. People generally like to be suggested things which they would like, and when they use a site which can relate to his/her choices extremely perfectly then he/she is bound to visit that site again. Provide Reports — Is an integral part of a personalization system. Giving the client accurate and up to the minute reporting allows him to make solid decisions about his site and the direction of a campaign. Based on these reports clients can generate offers for slow moving products in order to create a drive in sales.

Disadvantages: Cold-start problem: This issue has to do with making suggestions for new users or new things (Lika et al., 2014). ―In case of new users, the system does not have information about their preferences in order to make recommendations‖ (Lika et al., 2014). This means that user profiles (which are made up of ratings given to things) will be quite brief (Sobhanam & Mariappan, 2013). Poor scalability: Scalability, which is ―how quickly a recommender system can generate recommendations‖ (Ghazanfar & Prugel-Bennett, 2010). The inadequacy of this system to deal with rising users/items and deliver recommendations in a fair response time is one of the fundamental concerns with the in-memory CF technique (Singh, 2020). In general, When more people and things are added to the database, the entire rating database is searched in collaborative filtering, resulting in poor scalability (Kumar & Sharma, 2013). Sparsity: The ―sparsity‖ challenge is one of the most well-known issues in recommender systems (Sharifi et al., 2014). This problem stems from the fact that each user or object in a large data set has very little knowledge about them. To compensate for the scarcity, users' ratings in dense areas are first estimated, and these estimates are then utilized to estimate other ratings in sparse areas.

7. CONCLUSION

This literature review used keyword search and cross-references to collect units of analysis and the method of content analysis to review gathered research papers from 1996 to 2020. This paper provided an overview of different fields, techniques used in the Recommendation system, benefits, and challenges when using the Recommendation system in ecommerce. We collected most articles related to clustering algorithms and combinations of machine learning algorithms. The results found that the application of these algorithms significantly improves the accuracy, partially solving the problems that the recommendation system encounters. Through research papers, we have drawn a number of benefits of the suggestion system: Increased sales/conversion, user satisfaction, customer loyalty; Reduced issues, enabling to solve the problem of cold start; Increasing of efficiency and reducing costs on business process. Besides, the suggestion system still has many challenges that need to be improved, such as the Cold-start problem, poor scalability, sparsity. There are several limitations of this paper, including the number of reviewed papers and the level of quantitative content analysis. Therefore, future research can deploy qualitative approaches or combine qualitative and quantitative approaches to gain the best insights into this field of research.

8. REFERENCES

[1] Marko Balabanovic and Yoav Shoham 1997. Fab: Content-based, collaborative recommendation. Communications of the ACM, 40(3): pp. 66-72.

[2] Chumki Basu, Haym Hirsh, and William Cohen 1998. Recommendation as classification: using social and contentbased information in recommendation. In Proceedings of the 1998 Workshop on Recommender Systems, pages 11-15.

[3] Joseph A. Konstan, Bradley N. Miller, David Maltz, Jonathan L. Herlocker, Lee R. Gordon, and John Riedl 1997. GroupLens: Applying collaborative filtering to Usenet news. Communications of the ACM, 40(3): pp 77-87.

[4] Don Peppers and Martha Rogers 1997. The One to One Future : Building Relationships One Customer at a Time. Bantam Doubleday Dell Publishing.

[5] B. Joseph Pine II 1993. Mass Customization. Harvard Business School Press. Boston, Massachusetts

[6] B. Joseph Pine II, Don Peppers, and Martha Rogers 1995. Do you want to keep your customers forever? Harvard Business School Review, 1995(2): pp. 103-114

[7] Bai, Y., Jia, S., Wang, S., & Tan, B. (2020). Customer Loyalty Improves the Effectiveness of Recommender Systems Based on Complex Network. Information, 11(3), 171.

[8] https://doi.org/10.3390/info11030171 Balabanovic, M., & Shoham, Y. (1997). Combining Content-Based and Collaborative Recommendation. Communications of the ACM, 40, 66– 72.